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GB 1153616  
GB 0753894  
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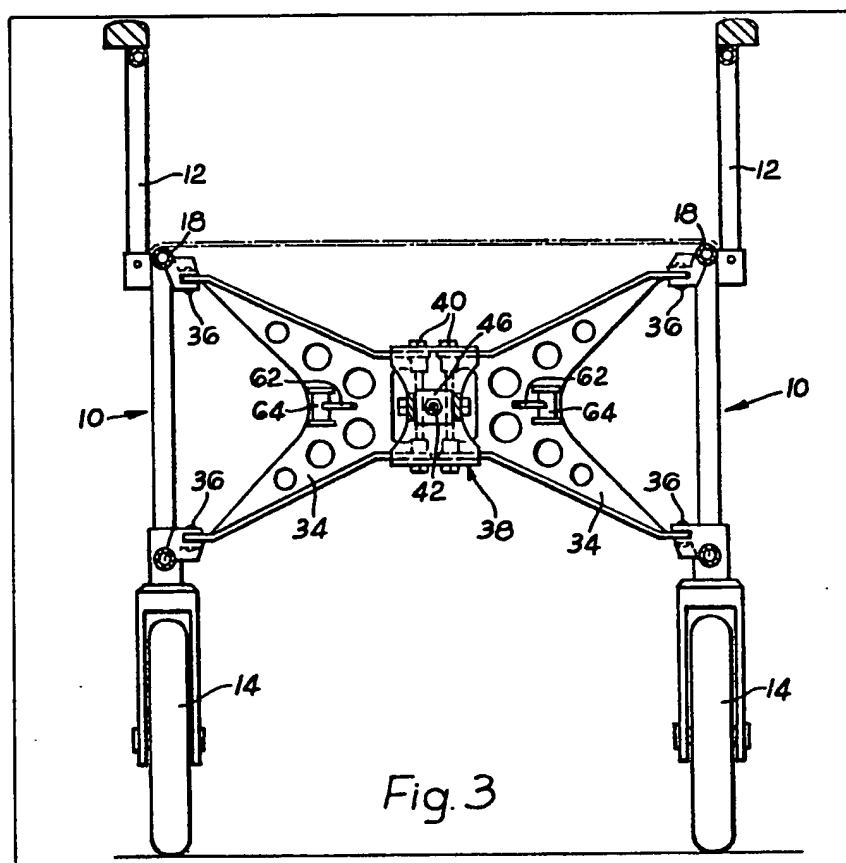
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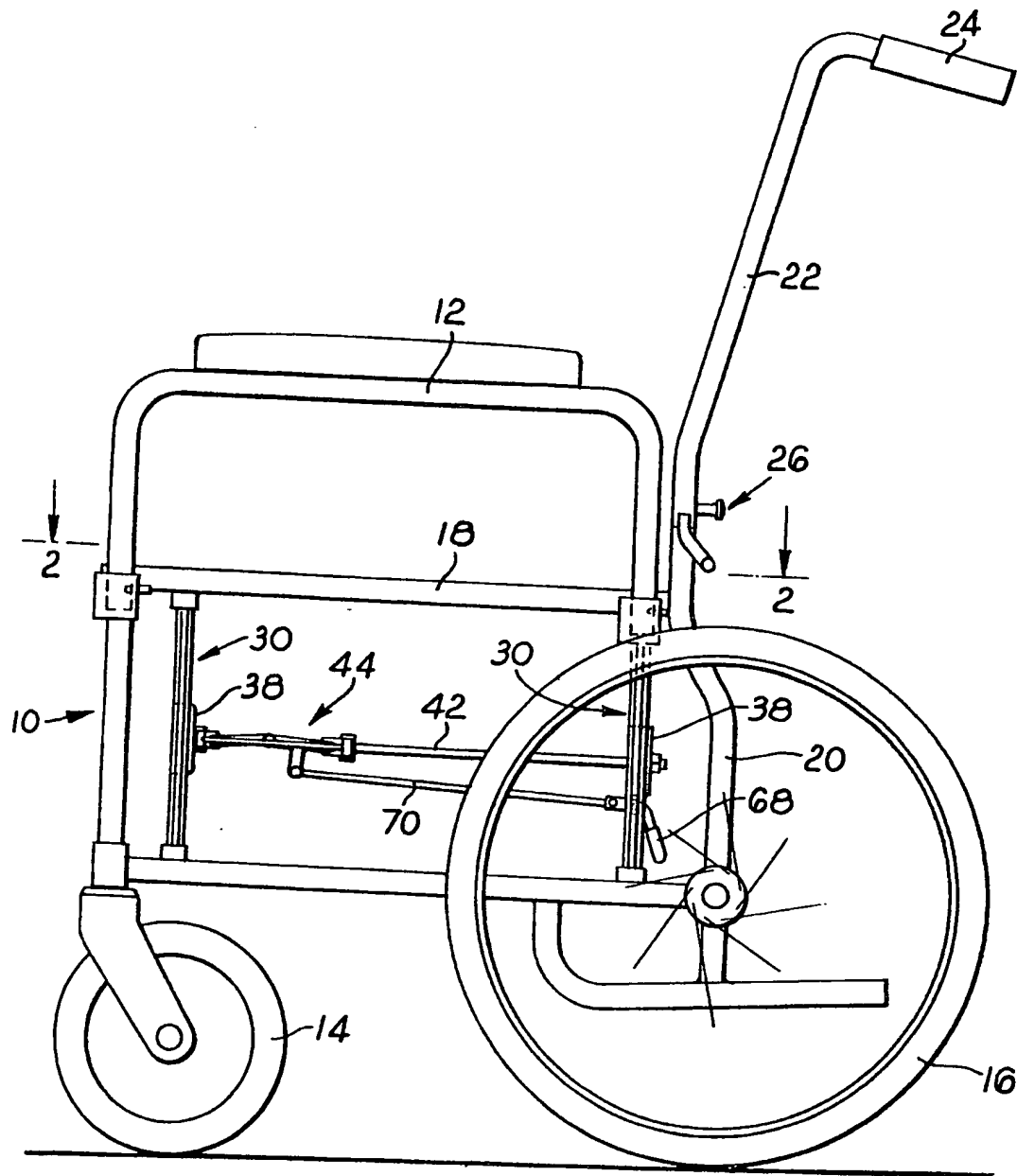
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(54) A collapsible wheelchair

(57) Side frames (10) are interconnected by front and rear linkages comprising arms (34) which fold about generally vertical axes (36, 40) so that the side frames (10) can be moved towards and away from one another to collapse or erect the chair. The arms (34) are connected to centrally located brackets (38) which are connected together by a rod (42) for coordinated movement. A holding device is provided which has an over centre action in order to releasably hold the arms (34) in the straight line position and thereby securely maintain the chair erected until it is to be collapsed.



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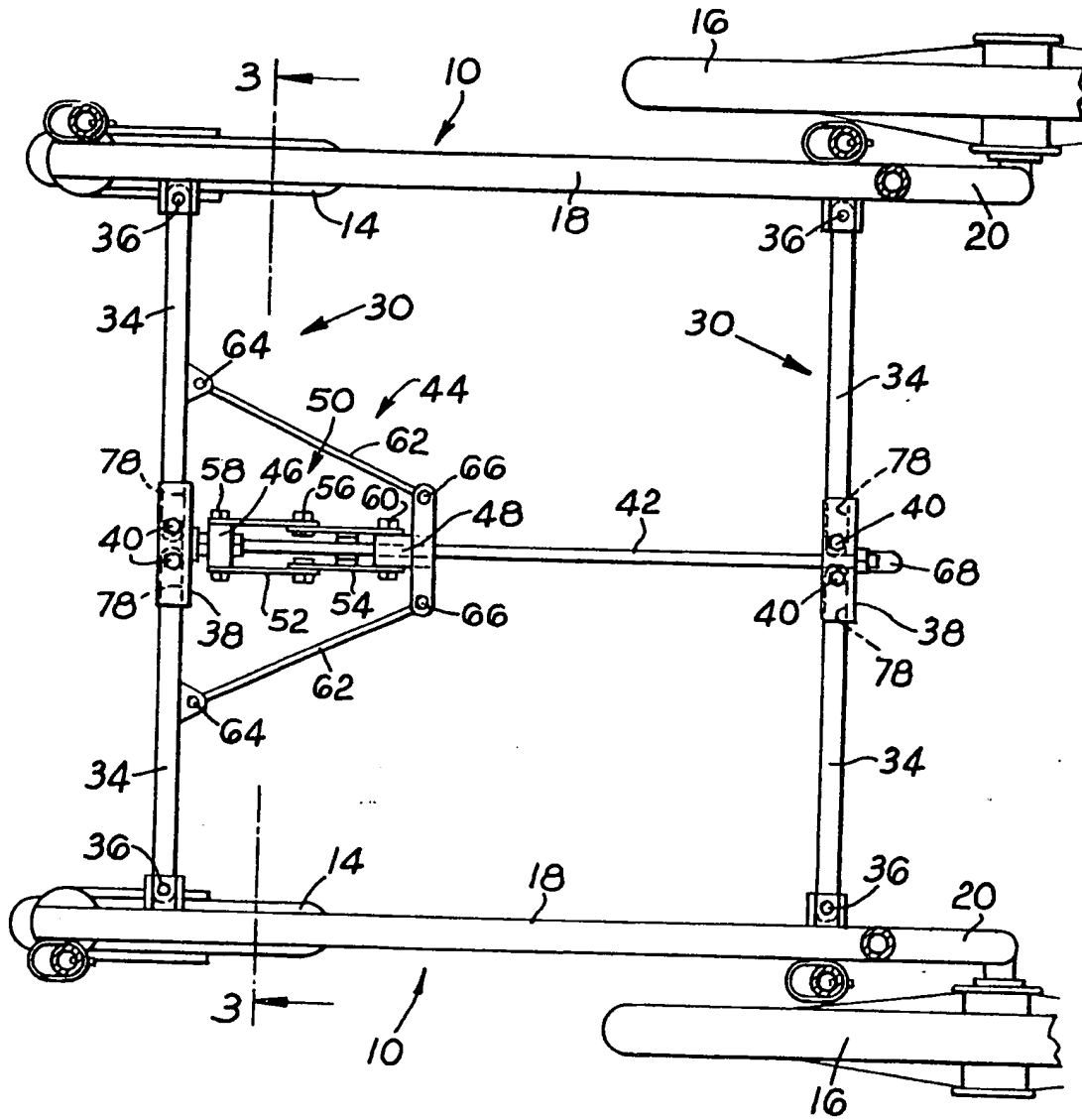


Fig. 2

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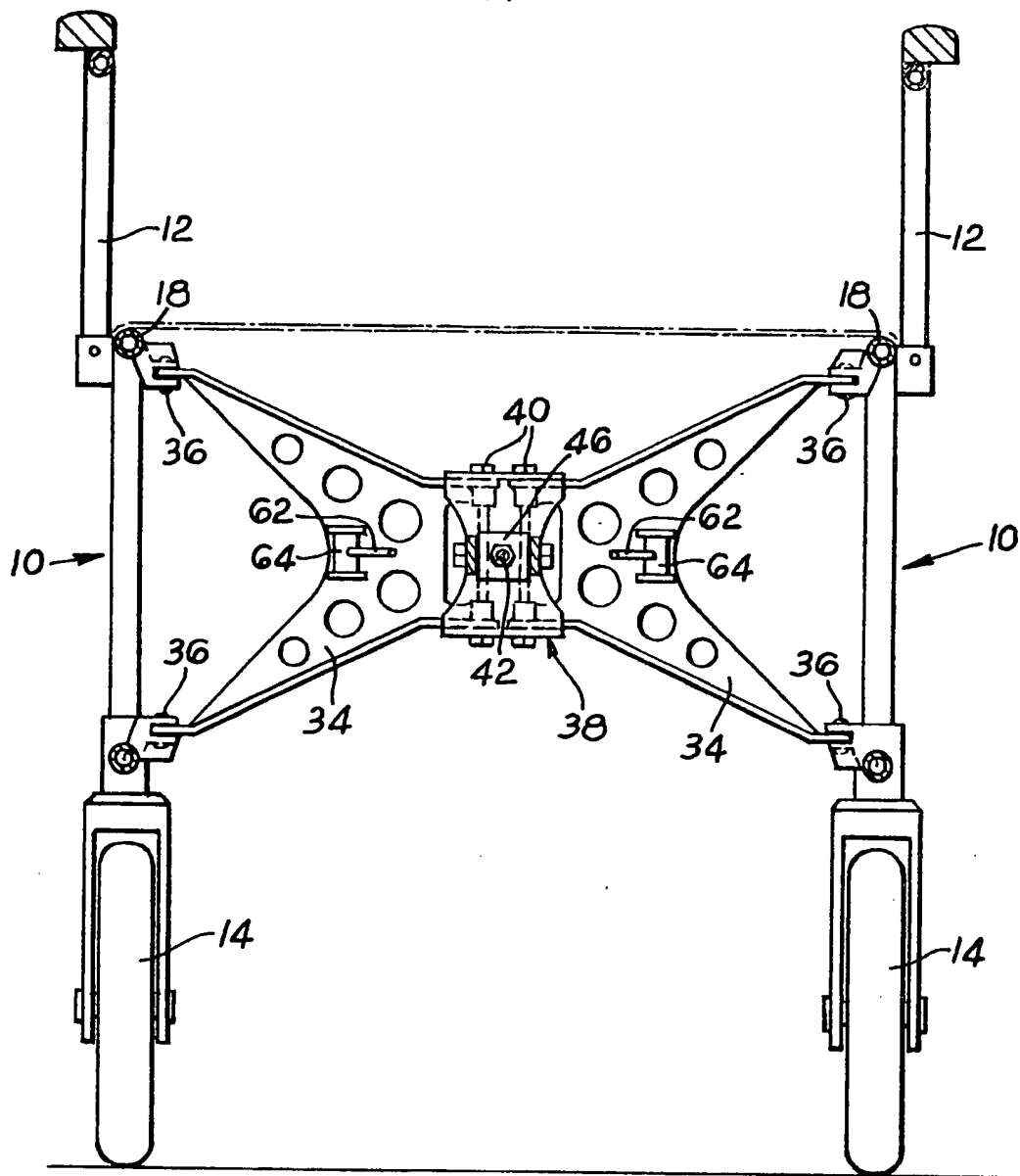


Fig. 3

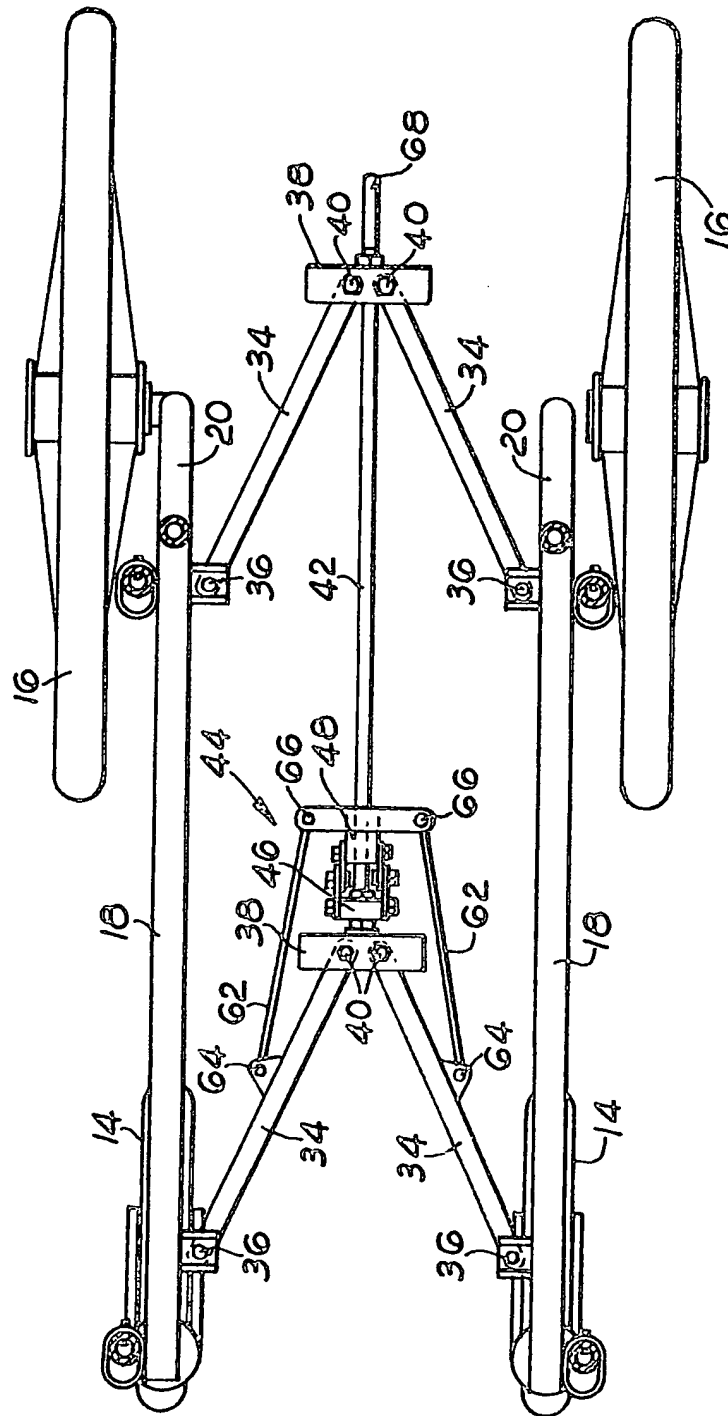
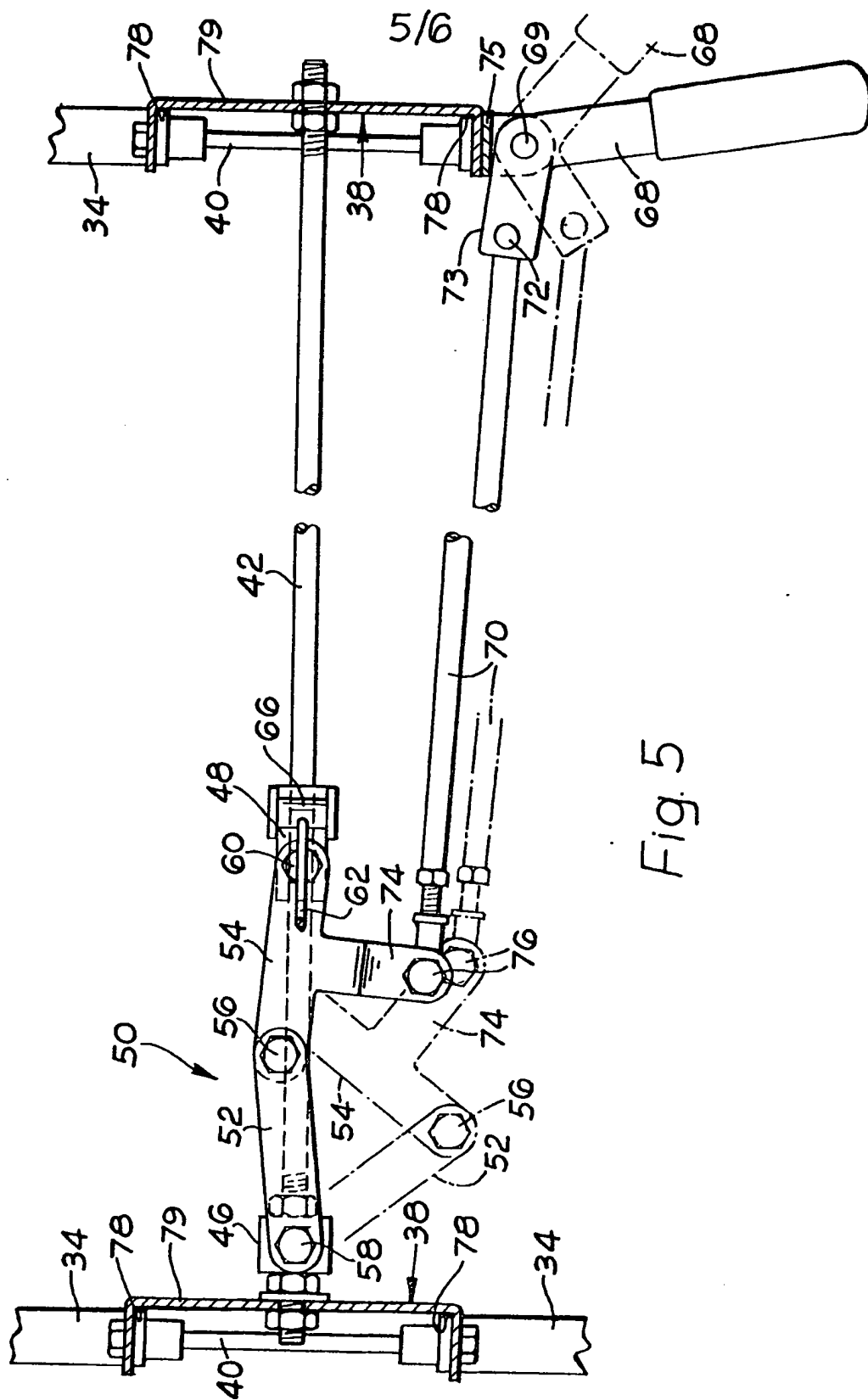
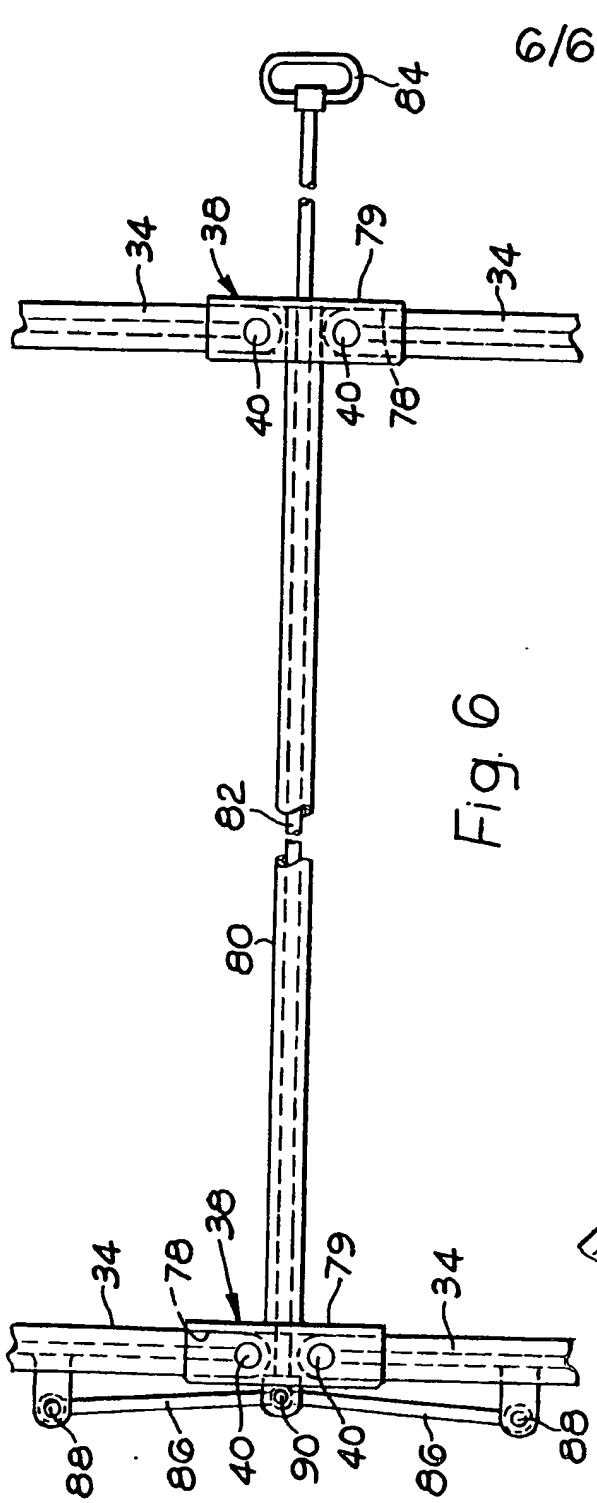
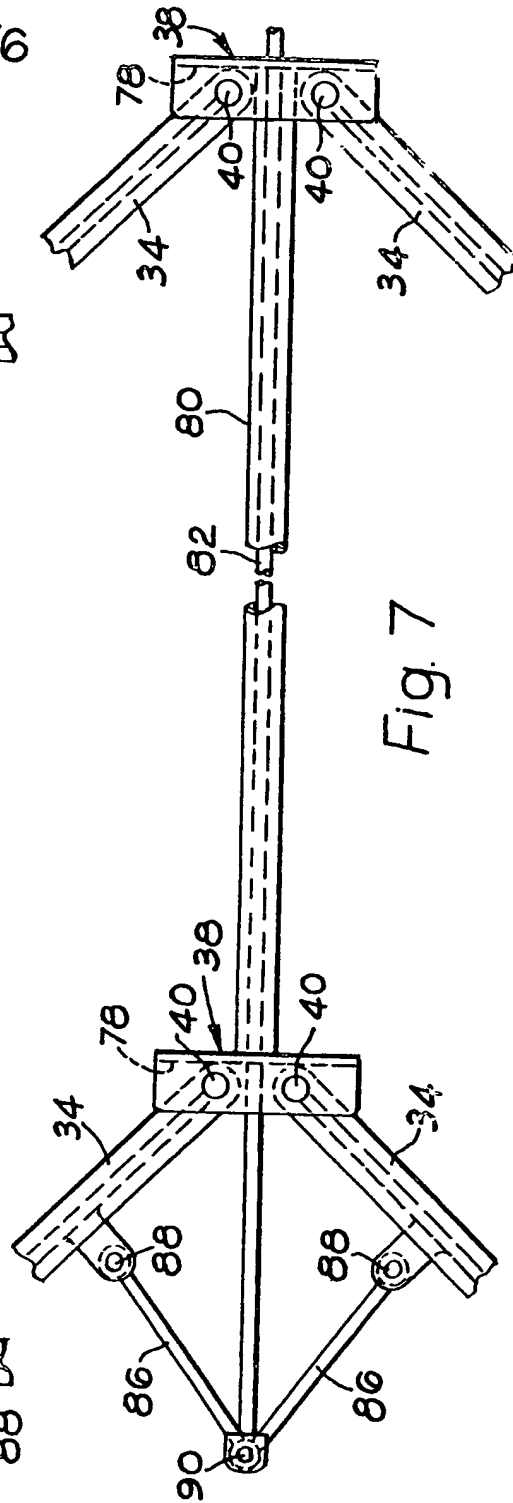


Fig. 4





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## SPECIFICATION

### A collapsible wheelchair

5 This invention relates to collapsible wheelchairs and especially wheelchairs of the type which are so constructed that they can be collapsed to a sufficiently small size as to enable them to be transported in for example the boot of a small car.

10 In known forms of wheelchair of this type, for example as disclosed in Patent No. 1140204, the linkages which connect together the side frames of the wheelchair are foldable so as to allow the side frames to be moved towards and away from one another. To achieve a compact size when the wheelchair is collapsed, Patent No. 1140204 discloses the use of linkages which fold about horizontal axes in such a way that the central pivot moves downwardly in response to movement of the side frames towards each other.

The linkage construction of Patent No. 1140204 however is not particularly adaptable to production of wheelchairs in a range of widths (i.e. different spacings between the side frames when the wheelchair is in the erect condition) since any increase or reduction in the lengths of the links tends to upset the kinematics and geometry of the linkages. Additionally, there is a tendency for play to develop in the pivotal connections between the links which means that, in the erected condition of the wheelchair, the side frames tend not to be held apart with the degree of rigidity that is desirable.

The object of the present invention is to provide an improved wheelchair construction which overcomes or at least substantially reduces the above mentioned drawbacks.

40 According to the present invention we provide a collapsible wheelchair comprising a pair of side frames interconnected by linkages which allow movement of the side frames towards and away from one another in order to collapse or erect the chair and means for releasably holding the linkages in the positions they adopt when the chair is erected, characterised in that said linkages are foldable about generally vertical axes.

Thus, in the present invention the linkages fold about generally vertical axes and this enables the geometry to be simplified to the extent that variations in the lengths of the links, in order to achieve different wheelchair widths, do not interfere with the kinematics and geometry of the linkages. Moreover because the pivotal connections about which the linkages fold are vertical, they are not subject to loading of the same degree as horizontal pivotal connections when for instance the chair is occupied and consequently there is less tendency for play to develop in the generally vertical pivotal connections.

65 In the preferred embodiment, the releasable

holding means has an over centre action such that forces tending to fold the linkages in the direction of collapse are translated into opposing forces which tend to fold the linkages in the reverse direction.

70 in order to promote further understanding of the invention, embodiments thereof will now be described by way of example only with reference to the accompanying drawings 75 in which:

*Figure 1* is a side view of the wheelchair shown in its erected condition;

*Figure 2* is a plan view of the wheelchair, the view being taken in the direction 2-2 in 80 Fig. 1;

*Figure 3* is a sectional view taken along the line 3-3 in Fig. 2;

*Figure 4* is a plan view similar to that of Fig. 2 but showing the wheelchair in its 85 partially collapsed condition;

*Figure 5* is a side view on an enlarged scale showing the details of the releasable holding means;

*Figure 6* is a plan view of an alternative 90 form of releasable holding means as seen when the chair is in its erected condition; and

*Figure 7* is a similar plan view to Fig. 6 with the wheelchair partially collapsed.

Referring firstly to Figs. 1 to 5, the wheelchair 95 comprises two side frames 10 each provided with a removable, U-shaped, padded armrest 12, a castor 14 and a rear wheel 16. The upper tubes 18 of the side frames 10 provide anchorages to which a removable or 100 collapsible seat of for example flexible fabric can be attached in conventional manner. The rear tubes 20 of the side frames mount extension tubes 22 which form side members of the backrest and terminate in handgrips 24. 105 The tubes 22 are bridged by a collapsible back support (not shown) of for example flexible material. The backrest tubes 22 are pivoted to the rear tubes 20 about horizontal axes and are releasably secured in the upright 110 positions shown in Fig. 1 by locking devices 26 which can be released to allow the backrest to be folded downwardly about the horizontal axis so that the tubes 22 lie generally alongside the tubes 20.

115 The side frames 10 are connected together by front and rear linkages 30 whereby the side frames can be removed towards or away from each other in order to collapse or erect the chair. Each linkage 30 comprises a pair of 120 arms 34 each connected to a respective side frame by vertical pivots 36 and connected centrally of the chair to a bracket 38 by vertical pivot pins 40. The linkages therefore fold about vertical axes from the straight line 125 position shown in Fig. 2 through an intermediate position as shown in Fig. 4 into a fully closed position in which the arms 34 of each linkage lie generally parallel to one another, and vice versa. It will be noted that folding of 130 the arms 34 does not lead to their projecting



above the tubes 18, thereby ensuring a compact size when the chair is collapsed with the backrest folded down and the arms 12 removed.

5 The front and rear brackets 38 are rigidly connected by a rod 42 so that folding movements of the two linkages 30 are coordinated. In the erect condition of the chair with the links in the straight line condition shown in  
10 Fig. 1, the chair can be locked securely in this condition by a releasable holding device indicated generally by the reference numeral 44. The holding device comprises a fixed block 46 secured to the front bracket 38, a movable  
15 block 48 slidably mounted on the rod 42 and a linkage 50 connecting the blocks 46 and 48, the linkage 50 comprising two sets of links 52, 54 pivoted about horizontal axes at 56 (see especially Fig. 5) and to the respective blocks 46, 48 at 58, 60. The sliding  
20 block 48 is also pivotally connected to the front arms 34 by further links 62 pivoted about vertical axes at 64, 66.

The holding linkage 50 is controlled by a  
25 user-operable actuator 68 mounted pivotally at 69 to the rear bracket 38 and connected to actuator rod 70 which is pivoted about horizontal axes to the actuator 68 at 72 and to lever arm 74 provided on the links 54 at 76.  
30 During normal folding movements of the front and rear linkages 30, the pivot 56 lies below the straight line condition of the links 52, 54. When the side frames 10 have been pulled apart to virtually the full extent permitted by  
35 the linkages 30, the actuator 68 can be foot operated to swing it about pivot 69 from the broken outline position shown in Fig. 5 to the full outline position until pivot 72 lies over centre and portion 73 abuts against a stop  
40 surface 75 on the rear bracket 38. This action displaces the pivot 56 over centre to the solid outline position seen in Fig. 5 and serves to complete movement of the linkages 30 to the straight line position and also oppose return  
45 movement thereof owing to the over centre position of the linkage 50.

In the straight line position, the front and rear arms 34 abut stop surfaces 78 provided by the bases 79 of the channel shaped brackets 38. By virtue of the over centre action of the linkage 50 and the arrangement of the links 62, it will be seen that any forces  
50 tending to collapse the linkages 30 are counteracted since their effect is to thrust the links 34 more firmly against the stop surfaces 78 of the bracket bases 79. Consequently the side frames 10 are held securely and rigidly apart when the chair is fully erected and they can only be brought towards one another to  
60 collapse the chair by returning the actuator 68 towards the broken outline position shown in Fig. 5 in order to break the over centre action of the linkage 50. When the locking device is released in this manner, the chair can be  
65 readily collapsed by pressing downwardly on

the fabric seat to cause the side frames 10 to move towards one another.

As shown in Figs. 1 to 5, the linkages 30 fold in the same direction as one another;  
70 however they may fold in opposite directions to one another with appropriate modifications of the holding device to ensure that the chair is securely held in the erected condition. Also, the arrangement of the linkages 30 may be  
75 reversed so that they both fold forwardly during chair collapse instead of rearwardly, as shown.

Figs. 6 and 7 illustrate an alternative form of holding device. In this modification, the  
80 brackets 38 are rigidly connected together by a tube 80 through which an actuating rod 82 extends. At one end, e.g. the rear end, the rod 82 terminates in a handle 84 by means of which the rod can be displaced forwardly or  
85 rearwardly. At its other end, the rod 82 is coupled to the arms 34 of the adjacent linkage 30 by links 86 pivoted at 88, 90. When the side frames have been displaced apart to virtually their full extent, the rod 82 is pulled  
90 to the right thereby bringing the linkages 30 into their straight line condition in which the links 34 abut against the stop surfaces 78 provided by the bracket bases 79. This action  
95 also serves to bring the pivot 88 into the over centre condition whereby forces tending to collapse the linkages 30 are counteracted since their effect is to thrust the links 34 more firmly against the stop surface 78. When the chair is to be collapsed, the actuating rod is  
100 displaced to the right to break the over centre action and allow folding of the linkages 30.

#### CLAIMS

1. A collapsible wheelchair comprising a  
105 pair of side frames interconnected by linkages which allow movement of the side frames towards and away from one another in order to collapse or erect the chair and means for releasably holding the linkages in the positions they adopt when the chair is erected, characterised in that said linkages are folded about generally vertical axes.

2. A wheelchair as claimed in Claim 1 in which said linkages are provided adjacent the  
115 front and rear of the chair and are coupled together for coordinated folding movement.

3. A wheelchair as claimed in Claim 2 in which the holding means is operable directly on one only of said linkages.

4. A wheelchair as claimed in Claim 2 or 3 in which the coupling means between the front and rear linkages comprises a rigid element extending fore-and-aft of the chair.

5. A wheelchair as claimed in any one of  
125 Claims 1 to 4 in which an actuator for operating said releasable holding means is located at the rear of the chair.

6. A wheelchair as claimed in any one of  
130 Claims 1 to 5 in which each linkage comprises a pair of arms pivotally interconnected

generally centrally of the chair and pivotally connected to respective side frames, the axes of said pivotal connections all being generally vertical.

- 5     7. A wheelchair as claimed in Claim 6 in which said arms are pivotally interconnected through the agency of a bracket having a stop surface or surfaces against which the arms abut when the chair is in the fully erected condition.

- 10    8. A wheelchair as claimed in Claim 7 when appendant to Claim 2, 3 or 4 in which said coupling means extends between the brackets of the front and rear linkages.

- 15    9. A wheelchair as claimed in any one of Claims 1 to 8 in which the linkages fold in the same direction as one another during collapse or erection of the chair.

- 20    10. A wheelchair as claimed in any one of Claims 1 to 8 in which the linkages fold in opposite directions to one another during collapse or erection of the chair.

- 25    11. A wheelchair as claimed in any one of Claims 1 to 10 in which, in the erect condition of the chair, the releasable holding means has an over centre action such that forces tending to fold the linkages in the direction of collapse are translated into opposing forces which tend to fold the linkages in the reverse direction.

- 30    12. A wheelchair as claimed in Claim 11 in which the plane with respect to which said over centre action of the releasable holding means takes place extends in the fore-and-aft direction of the chair.

- 35    13. A wheelchair as claimed in Claim 11 in which the plane with respect to which said over centre action of the releasable holding means takes place extends transversely of the chair.

- 40    14. A wheelchair as claimed in Claim 11, 12 or 13 when appendant to Claim 7 or 8 in which the over centre action is such that the counteracting forces cause the arms to abut more firmly against said stop surface or surfaces.

- 45    15. A wheelchair whose side frames are connected together for movement towards and away from one another by linkages substantially as hereinbefore described with reference to, and as shown in, Figs. 1 to 5 or Figs. 6 and 7 of the accompanying drawings.